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From natural to human-dominated floodplains - A Holocene perspective for the Dijle catchment, Belgium

Nils Broothaerts (1,2,3), Gert Verstraeten (1,2), Cornelis Kasse (3), Sjoerd Bohncke (3), Bastiaan Notebaert (1,4), and Jef Vandenberghe (3)

(1) KU Leuven, Department of Earth and Environmental Sciences, Leuven, Belgium (nils.broothaerts@ees.kuleuven.be), (2) KU Leuven, Centre for Archaeological Sciences, Leuven, Belgium, (3) VU University, Department of Earth Sciences, Amsterdam, The Netherlands, (4) Research Foundation Flanders – FWO, Brussels, Belgium

Floodplain systems underwent important changes in many West and Central European catchments through the late Holocene. To better understand the relation between these landscape changes and human disturbances, geomorphic fieldwork needs to be complemented by quantitative measures of human impact in the landscape. In this study, we provide an holistic discussion in which we combine detailed data on floodplain changes with detailed data on human impact for the Dijle catchment (758 km^2), Belgium. Human impact in the catchment was quantified based on statistical analysis of pollen data of six alluvial study sites. The results show that during the Neolithic Period, human impact was nearly absent and floodplains consisted of a strongly vegetated marshy environment where organic material accumulated, which is considered as the natural state of the floodplain. From the Bronze Age onwards, human impact increased and caused an increase in soil erosion and hillslope-floodplain connectivity. Consequently, sediment input in the floodplain system increased and floodplain geoecology changed towards an open floodplain dominated by clastic overbank deposits, mainly as the indirect result of an intensification of agricultural activities. Based on these data, a generalized model of floodplain development is presented: At the scale of the entire Dijle catchment, the gradual changes in floodplain morphology coincided with the gradually increasing human impact in the catchment, which suggests a linearity between the external forcing (human impact) and geomorphic response (floodplain change). However, at the narrow floodplains in the headwaters, the gradual increase in human impact contrasts with the abrupt change in floodplain geoecology, only triggered when human impact reached a threshold. Observed differences at catchment scale in time-lags and in the process-response model are attributed to differences in hillslope-floodplain connectivity, the location within the catchment and to differences in the timing and intensity of human activities between subcatchments. The study also shows that a holistic approach, integrating data from different study sites on a catchment scale, is needed to get more insights in the driving forces of environmental changes.